

U.S. Environmental Protection Agency Underground Injection Control Program

***Draft Permits and Proposed Aquifer Exemption
at the Dewey-Burdock In-Situ Uranium Recovery
Site near Edgemont, South Dakota***

Background:

The Underground Injection Control Program

- Authorized under the Safe Drinking Water Act
- Mission: to protect Underground Sources of Drinking Water by regulating injection activity and injection wells.
- An “Underground Source of Drinking Water” (USDW) is defined by regulation as an aquifer (or portion)
 - Which supplies any public water system; or
 - Which contains a sufficient quantity of ground water to supply a public water system; and
 - Currently supplies drinking water for human consumption; or
 - Contains fewer than 10,000 mg/l total dissolved solids.
- Classifies injection wells under 6 classes based on type of injectate and purpose for injection activity.
- May exempt a portion of a USDW from protection under the program based on certain criteria.

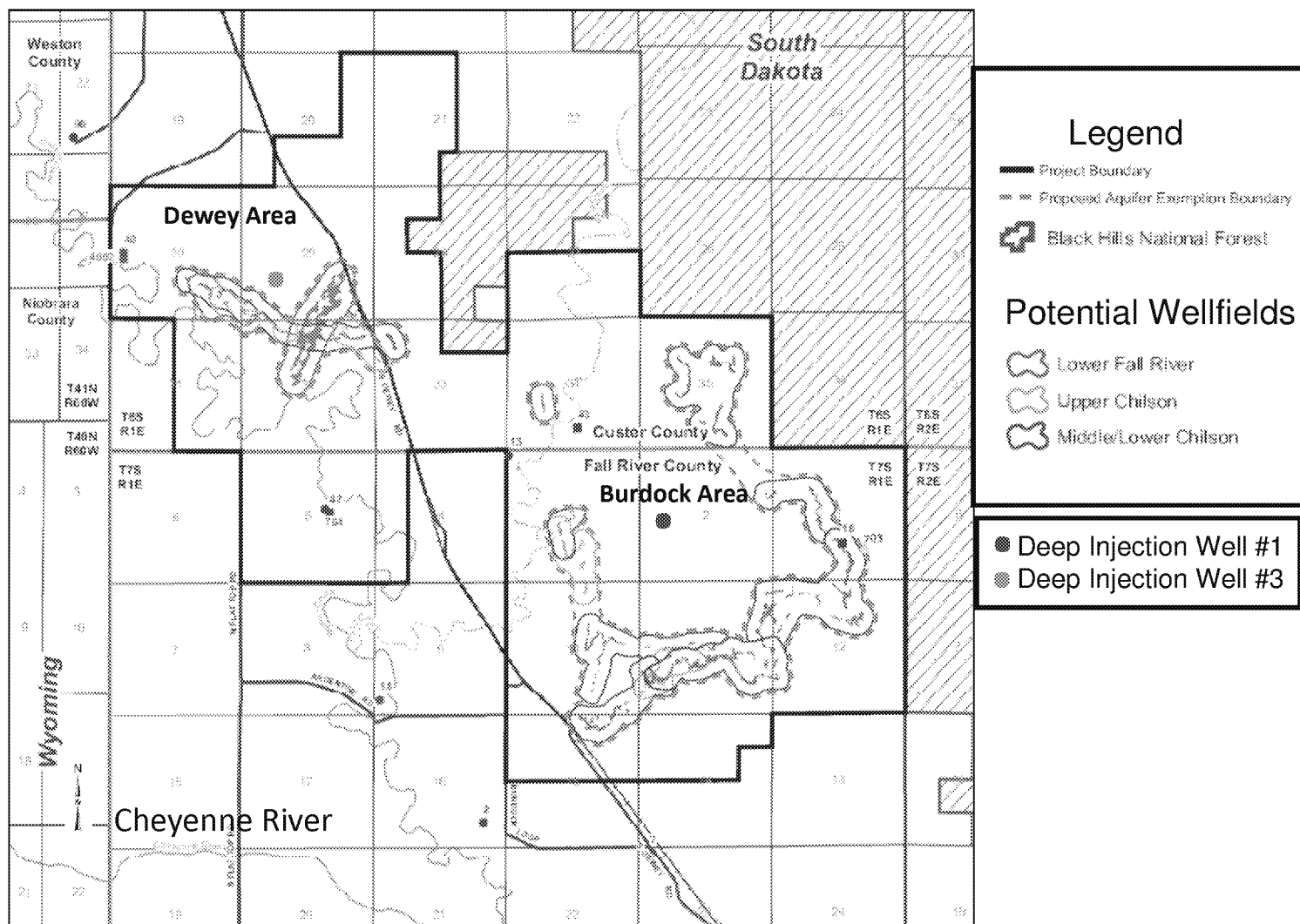
The Dewey-Burdock UIC Permits

- The Region 8 UIC Program issued two draft area permits on March 6, 2017.
 - One draft permit is a Class III Area Permit for injection wells for the in-situ recovery (ISR) of uranium in Inyan Kara aquifers;
 - The second draft permit is a UIC Class V Area Permit for deep injection wells that will be used to dispose of ISR process waste fluids into the Minnelusa Formation after treatment to meet radioactive waste and hazardous waste standards.
- The EPA is also proposing an aquifer exemption approval in connection with the Class III Area Permit to exempt the uranium-bearing portions of the Inyan Kara Group aquifers.
- The EPA also released for comment:
 - a draft Environmental Justice Analysis,
 - a draft Cumulative Effects Analysis, and
 - a draft document explaining process and considerations for Tribal Consultation.
- The EPA is requesting public review and comment on all of these documents.

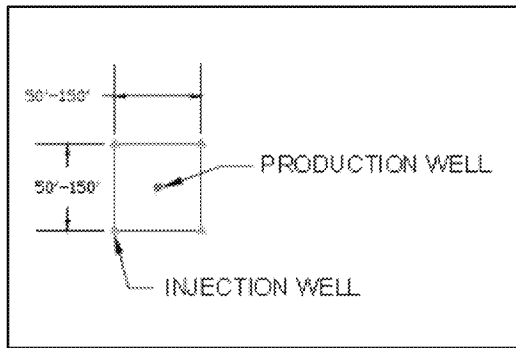
Other Regulatory Agencies at the Dewey-Burdock Site

- The Nuclear Regulatory Commission issued a Materials License for the project.
- The South Dakota Department of Environment and Natural Resources has proposed issuance of a Large Mine Permit.
- The BLM approved a Plan of Operations for portions of the site on BLM land.
- The South Dakota Department of Environment and Natural Resources has proposed issuance of a groundwater discharge permit for the land application of treated ISR waste fluids.

Dewey Burdock Proposed Class III Injection Wellfields, Aquifer Exemption Areas and Class V Deep Disposal Well Locations

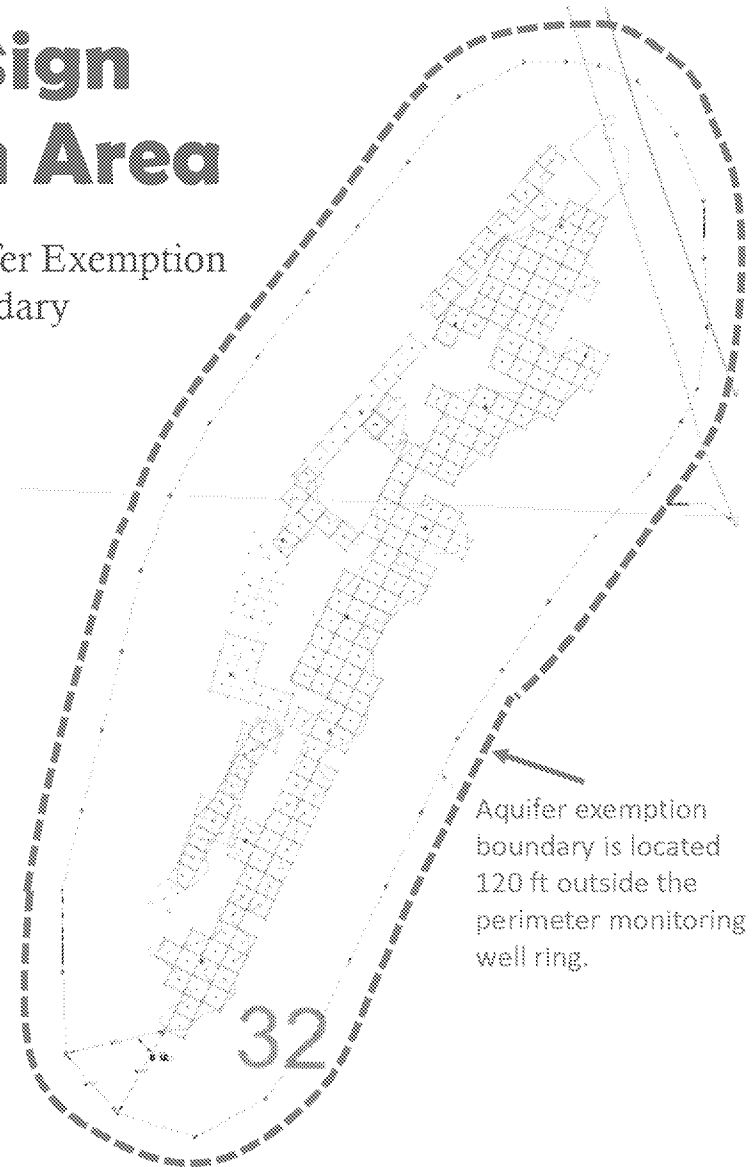


Class III Wellfield Design and Aquifer Exemption Area



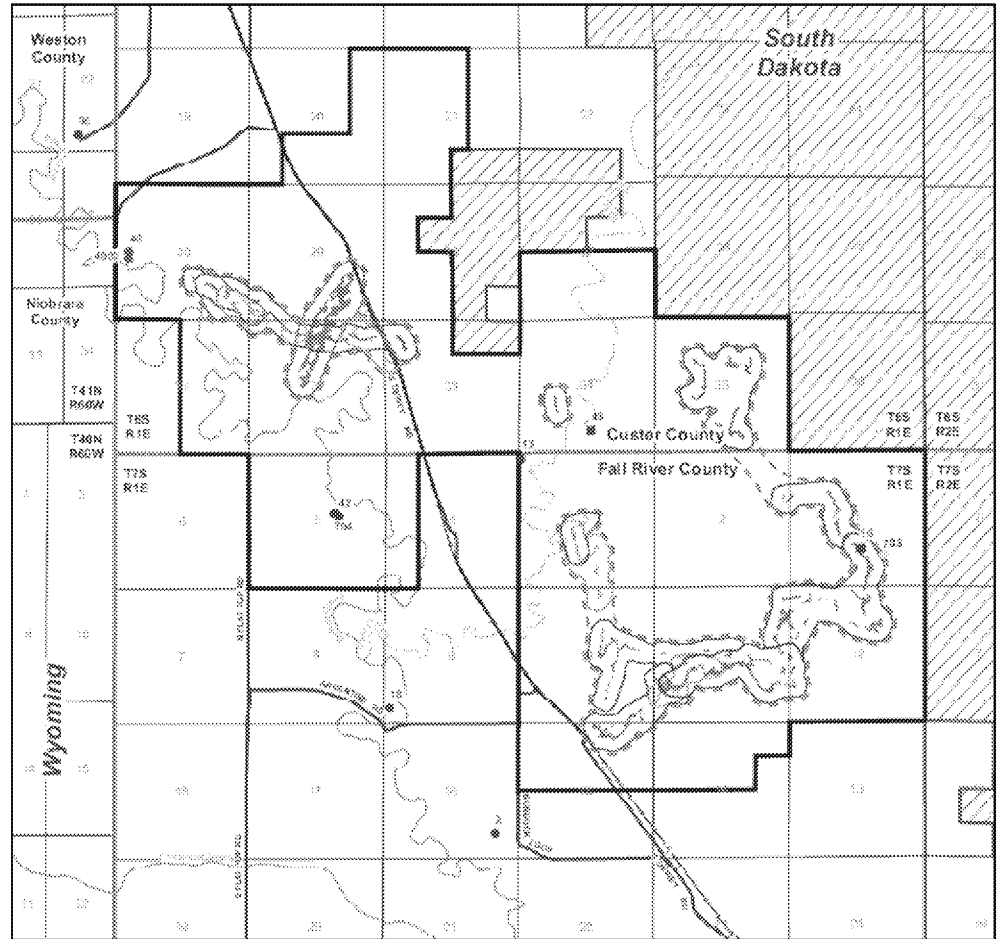
- ⊗ PERIMETER MONITOR WELL
- ⊕ OVERLYING MONITOR WELL
- ⊙ UNDERLYING MONITOR WELL

— Aquifer Exemption Boundary

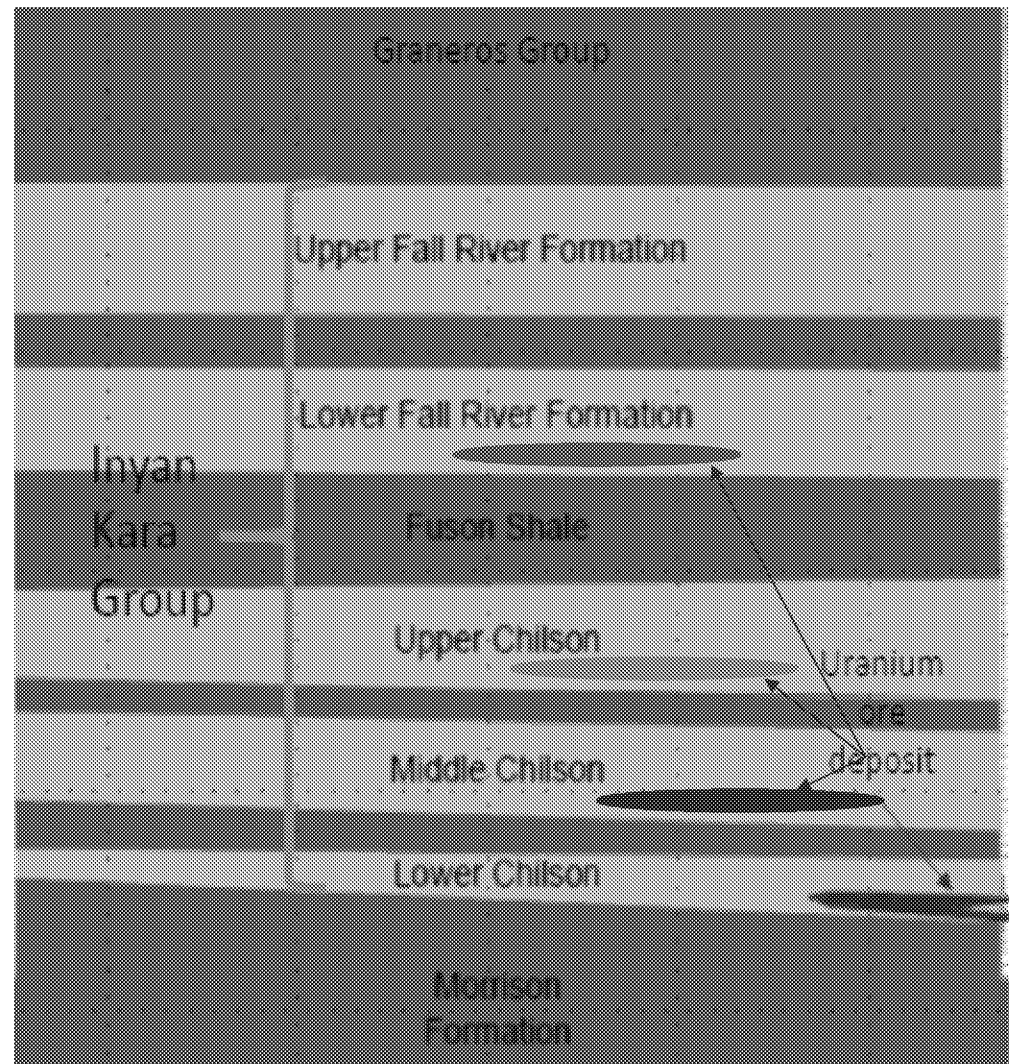


Inyan Kara Water Quality within Aquifer Exemption Area

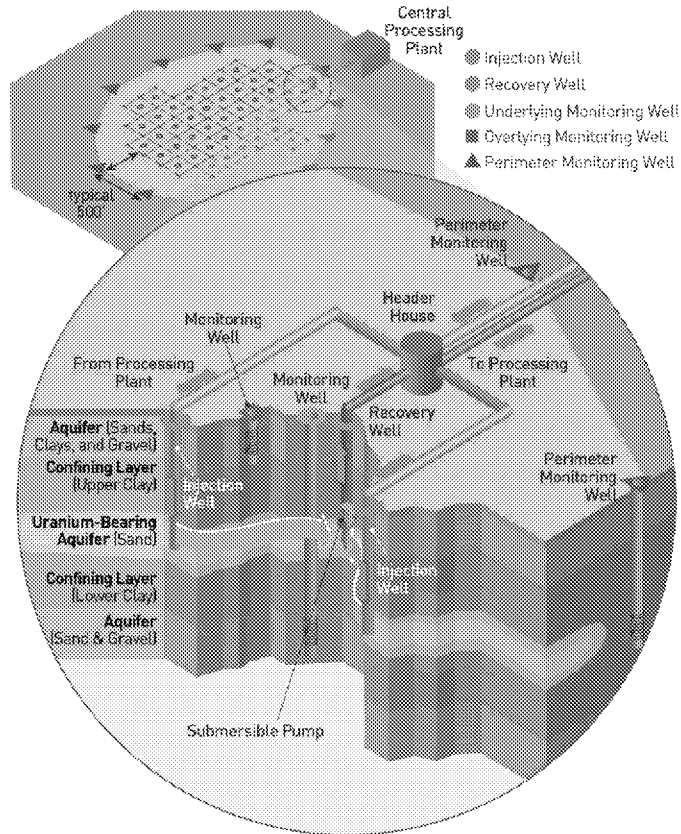
- Inyan Kara groundwater has to be treated before drinking to remove sulfate, manganese and iron.
- The Inyan Kara wells located within a uranium ore deposits also have high levels of gross alpha, radium and radon.
- Radioactive decay of uranium eventually results in radium, which quickly decays to radon and a series of daughter elements emitting alpha radiation.



Vertical Extent of the Aquifer Exemption Boundary



The In Situ Uranium Recovery Process



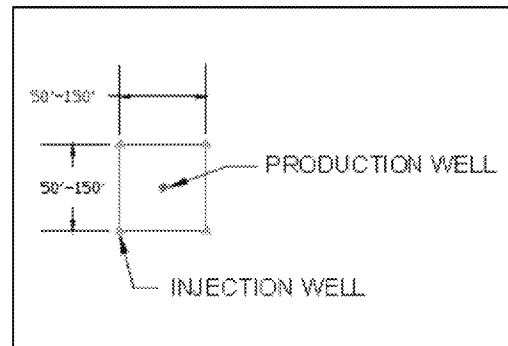
Injection wells ● pump a solution of native ground water, usually mixed with sodium bicarbonate and oxygen, into the aquifer (ground water) containing uranium ore. The solution dissolves the uranium from the deposit in the ground and is then pumped back to the surface through recovery wells ●, all controlled by the header house. From there, it is sent to the processing plant. Monitoring wells ● ■ ▲ are checked regularly to ensure that injection solution is not escaping from the wellfield. Confining layers keep ground water from moving from one aquifer to another.



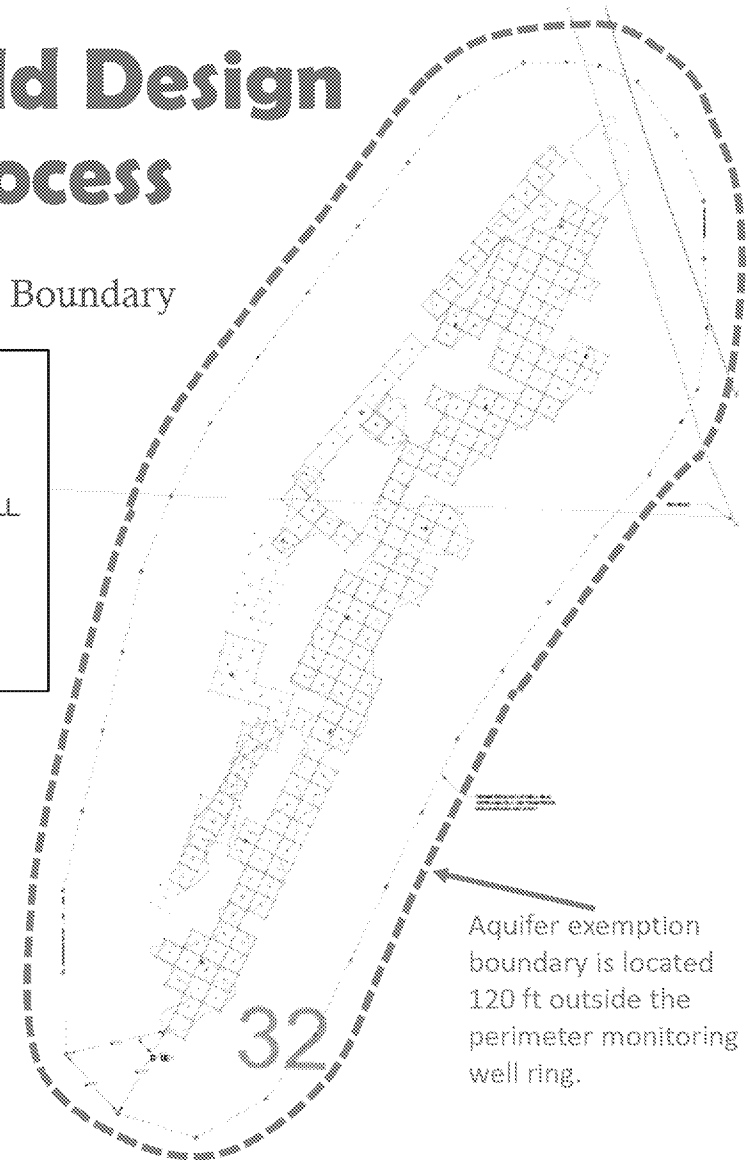
As of July 2016

Typical Wellfield Design and ISR Process

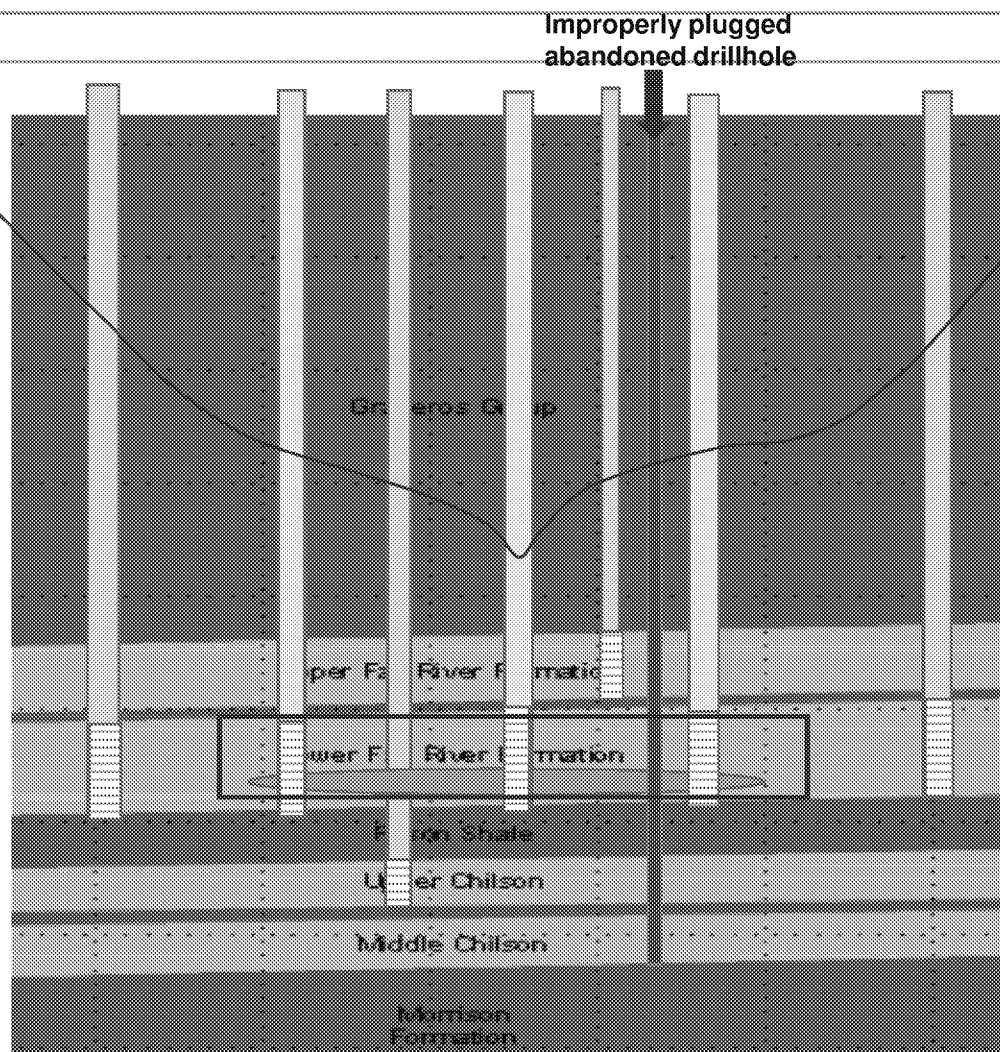
— Aquifer Exemption Boundary



- PERIMETER MONITOR WELL
- OVERLYING MONITOR WELL
- UNDERLYING MONITOR WELL



Wellfield Pump Tests



Upper Chilson groundwater level

Upper Fall River groundwater level

Lower Fall River groundwater level

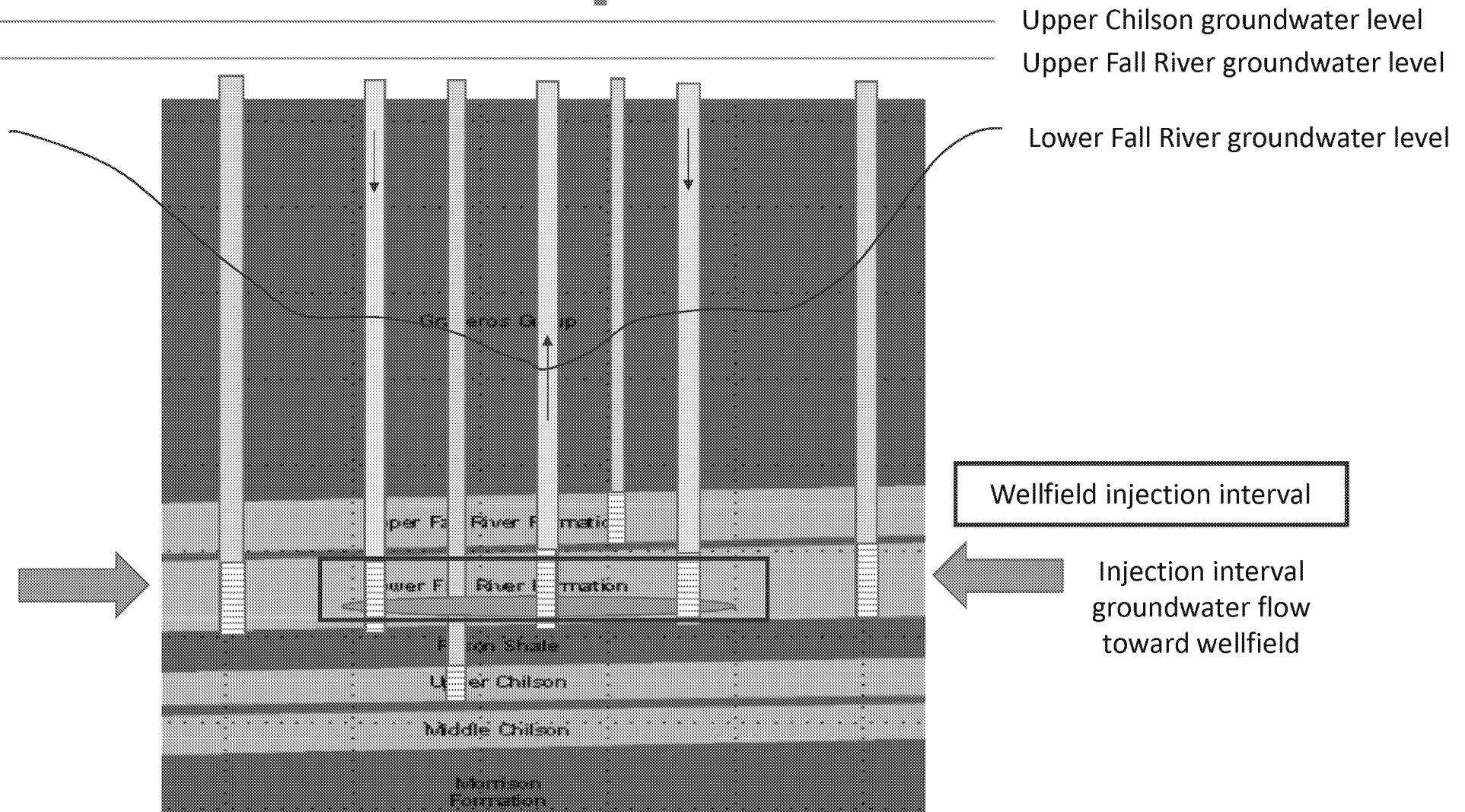
The UIC Class III draft permit requires extensive characterization of the geology and hydrology for each wellfield.

Crucial Question:
Can the uranium-bearing fluids be contained within the injection interval?

Pumping interval

Wellfield injection interval

Wellfield Operation



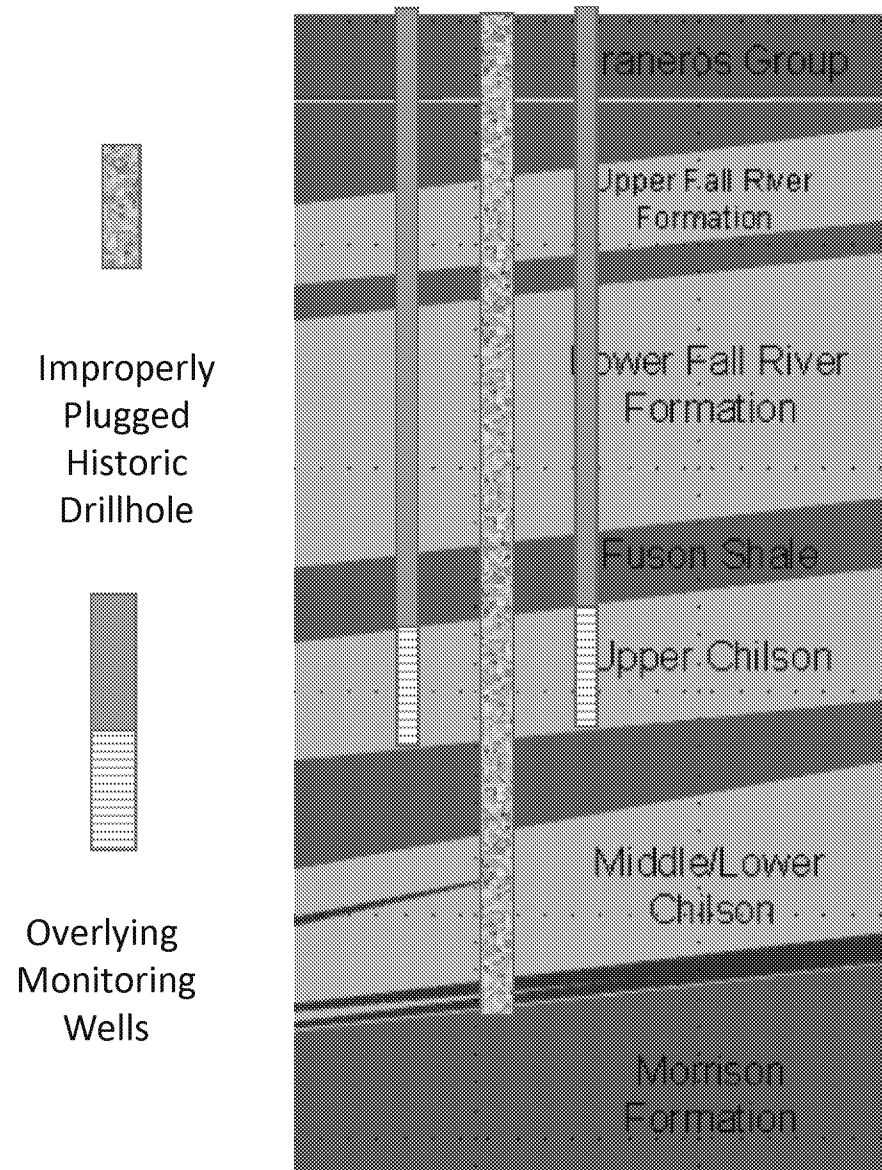
If the EPA issues final permits, Powertech cannot commence injection right away

There are numerous requirements for rigorous geologic and hydrologic characterization in both permits to verify that injection activity will not cause migration of injectate into USDWs.

Class III permit requirements include (among many others):

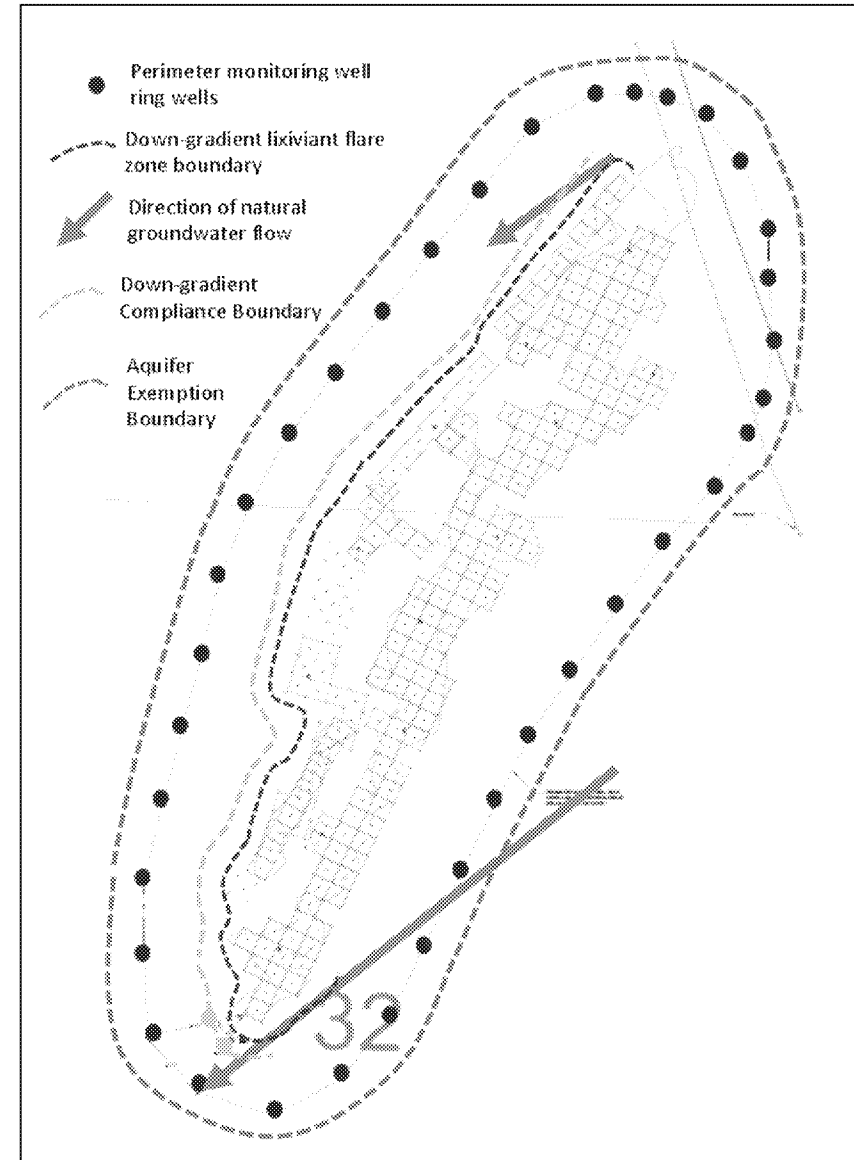
1. Map showing all plugged and abandoned exploration drillholes within the wellfield perimeter monitoring ring.
2. Identification of any exploration drillholes that had to be replugged.
3. Copies of any new or historic drillhole logs annotated to indicate presence of fault, fracture or joint for any drillholes located inside the perimeter monitoring well ring.

UIC regulations do allow ISR activities to occur in areas with breaches in the confining zones. In these situations, extra monitoring is required around the breaches.



Post-restoration Monitoring

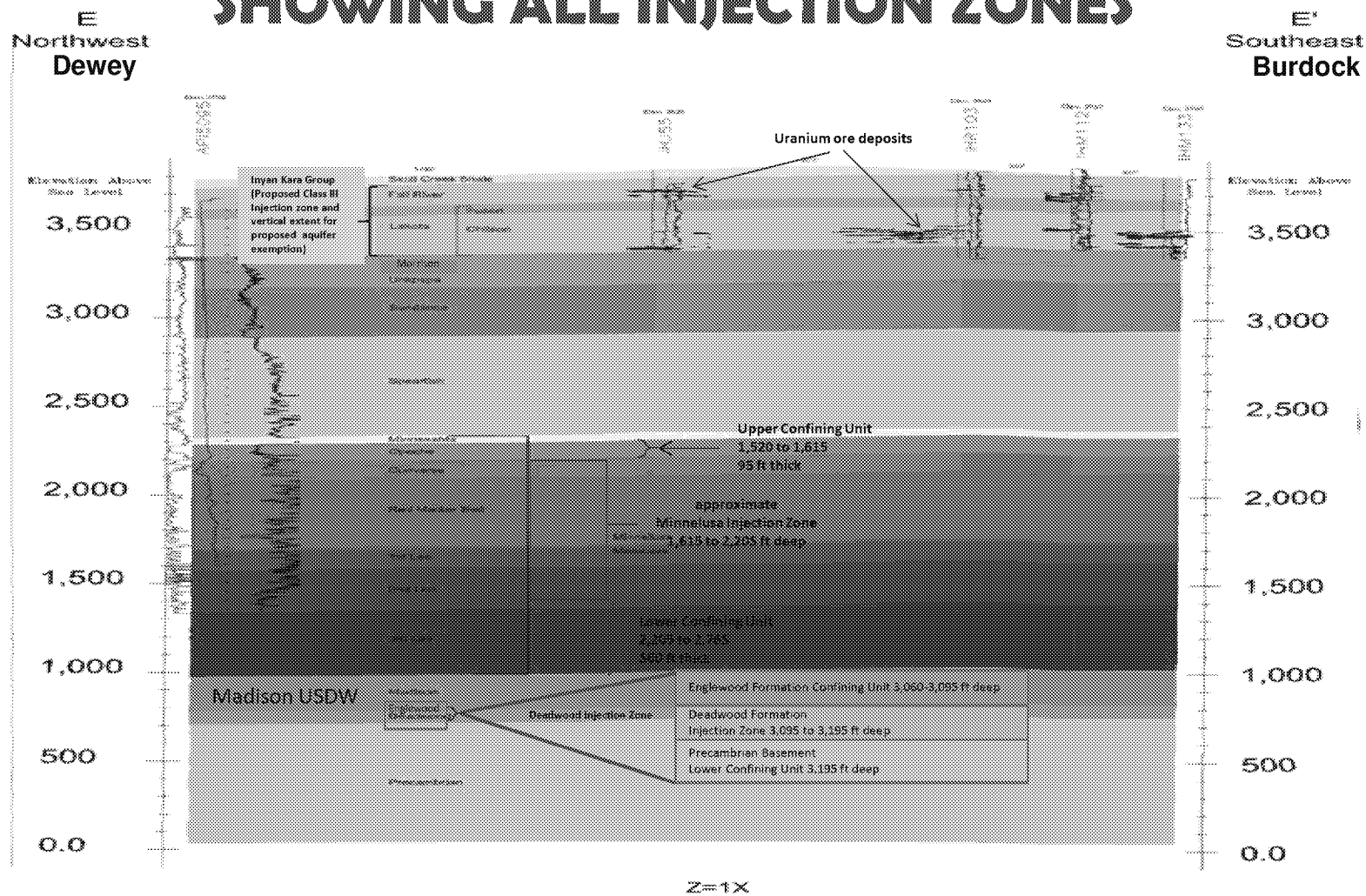
1. Begins after wellfield restoration is complete.
2. The Class III area permit requires a proposed post-restoration monitoring plan before wellfield pump tests begin.
3. Post-restoration monitoring plan includes establishing a down-gradient compliance boundary.
4. Groundwater baseline constituent concentrations are used as the permit limits for determining that no ISR contaminants cross the aquifer exemption boundary.
5. Baseline monitoring begins before wellfield pump tests.
6. Baseline permit limits and strategy for detection of statistically significant increase of an ISR waste constituent above permit limits are based on the RCRA Unified Guidance.

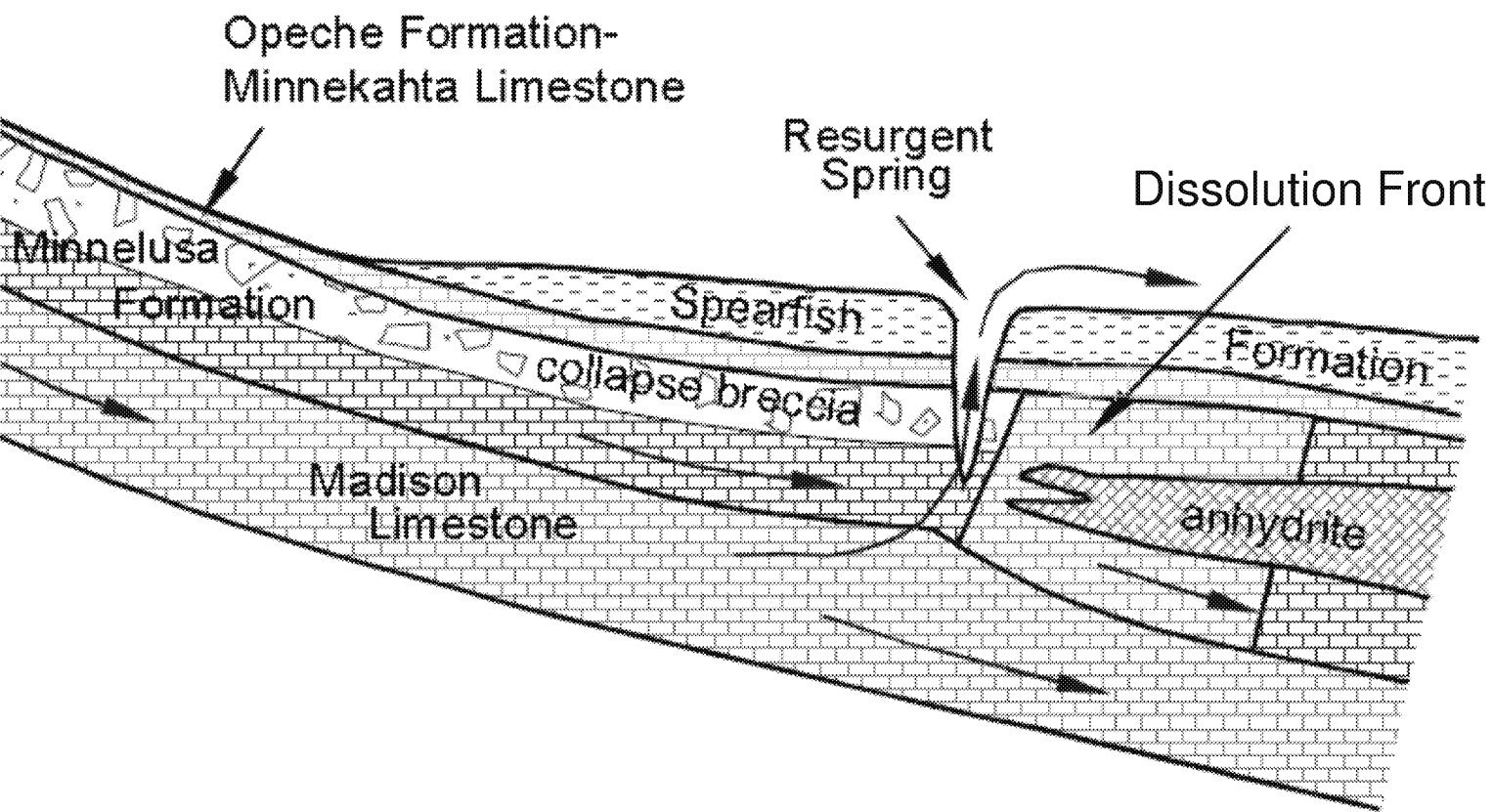


Class V Deep Injection Wells

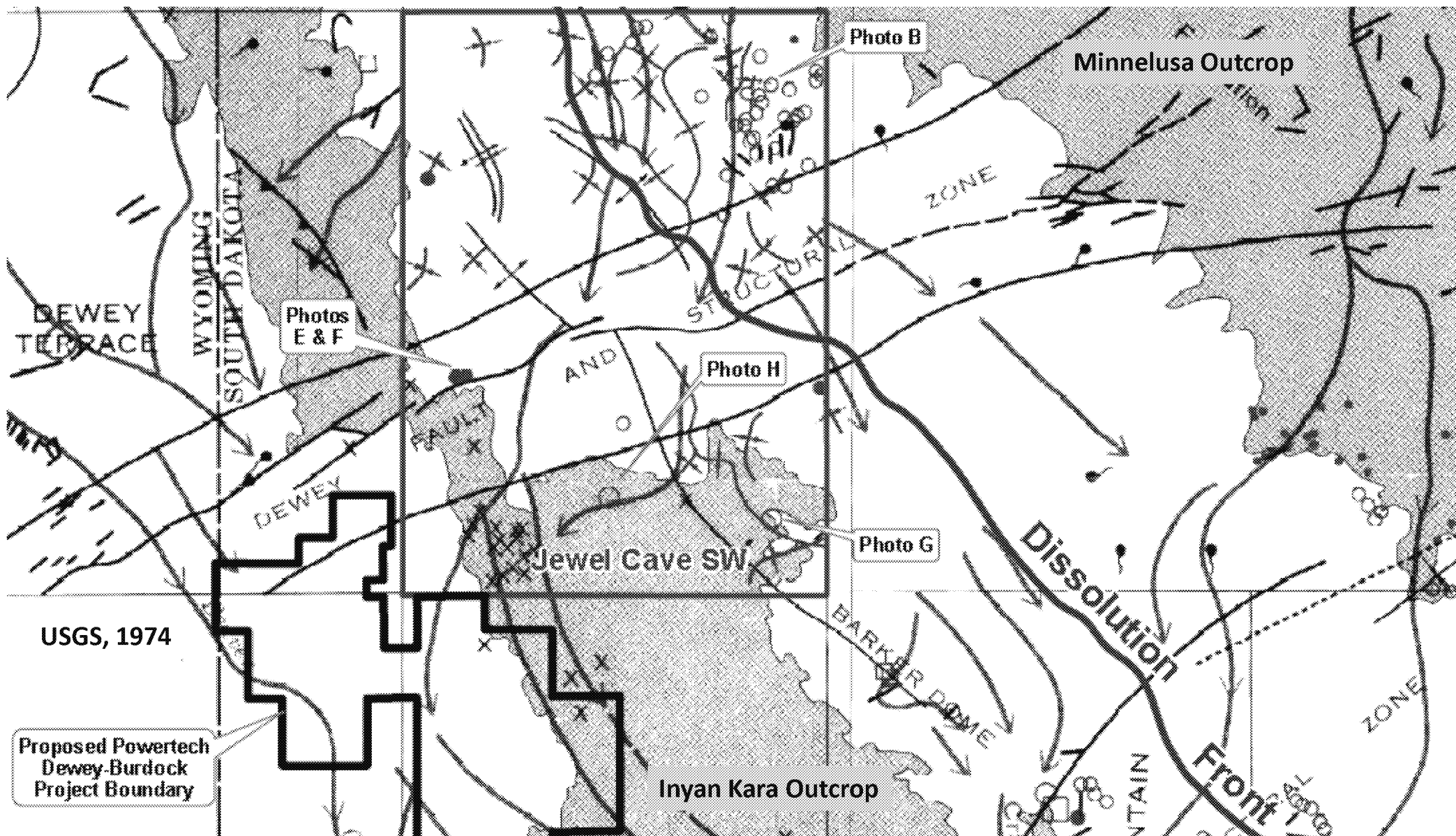
- This Class V permit requires the most protective well construction requirements under UIC regulations
- There are numerous requirements for rigorous geologic and hydrologic characterization to verify that injection activity will not cause migration of injectate into USDWs.
- Powertech must demonstrate that the Minnelusa is not an underground source of drinking water (USDW).
- The Class V permit does not allow injection into a USDW.
- The Class V permit requires the injectate to be treated to below radioactive waste and hazardous waste standards.

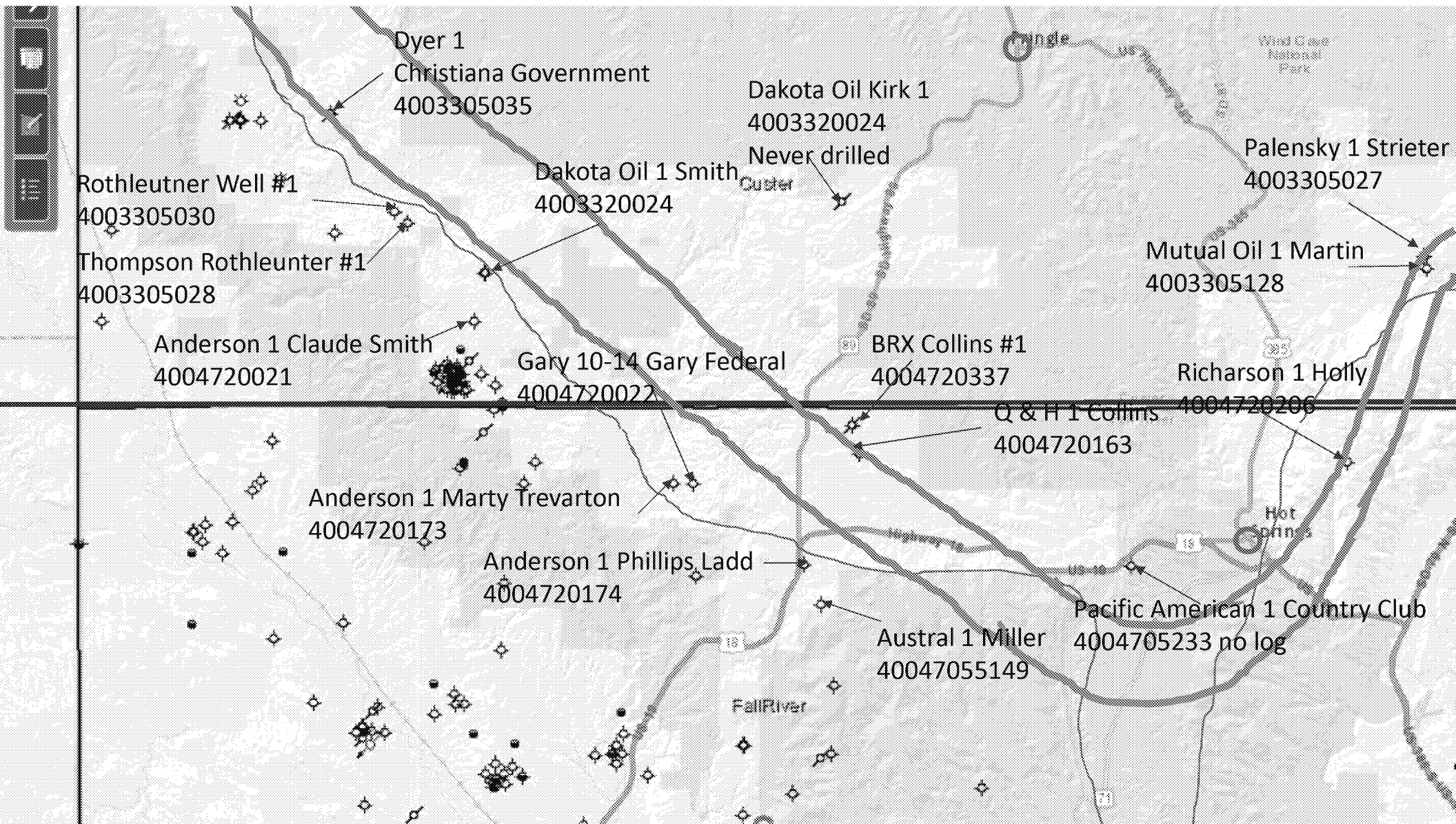
GEOLOGIC CROSS SECTION SHOWING ALL INJECTION ZONES





Groundwater pressure in the Madison aquifer is higher than the groundwater pressure in the Minnelusa aquifer





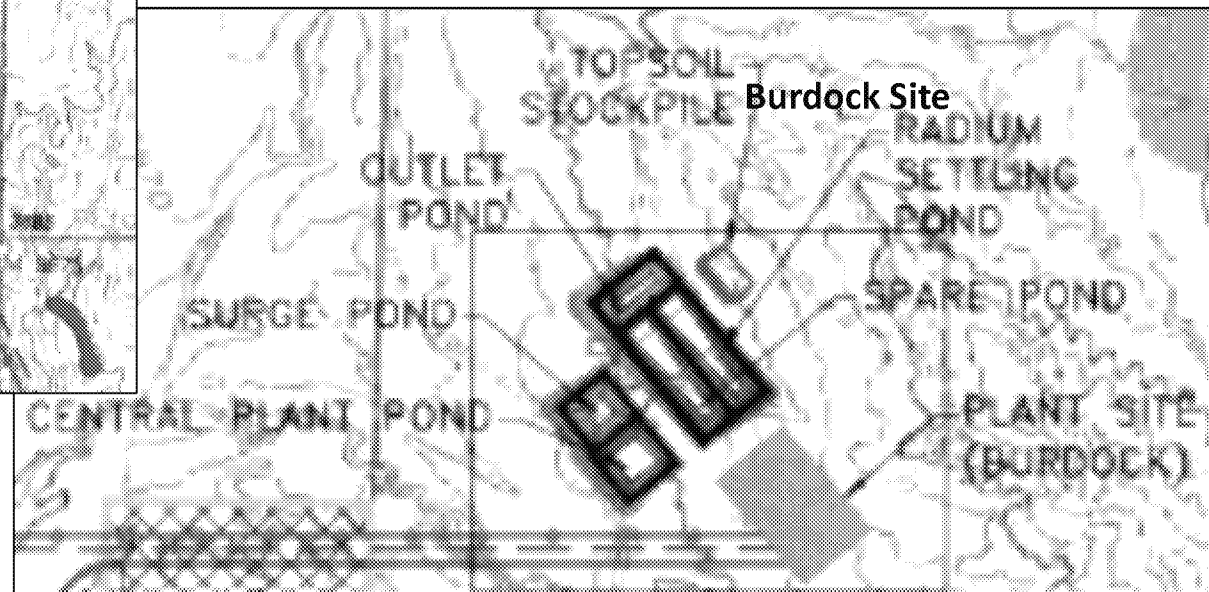
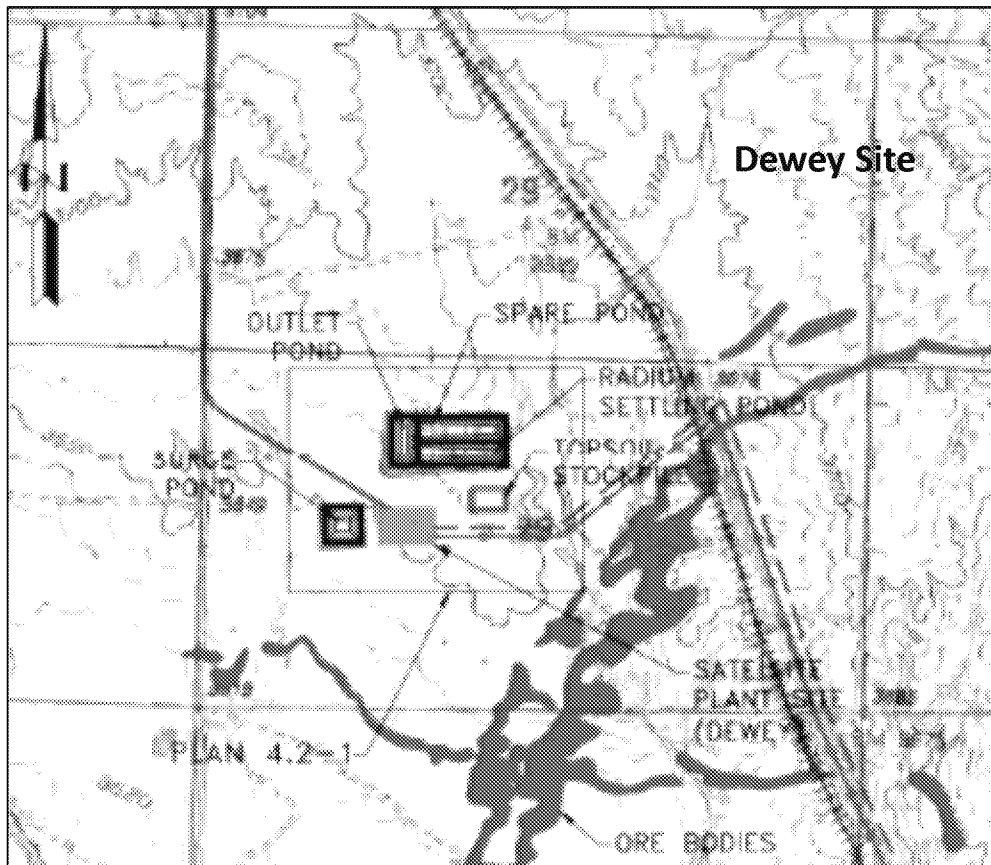
Class V Permit Requirements to Verify Large Scale Integrity of the Minnelusa Confining Zones:

1. Drill logs from deep Class V wells and plugged oil and gas wells shown in previous slide.
2. Groundwater levels of Minnelusa and Madison aquifers are different when they are not in hydrologic communication.
3. Sulfate concentration.
4. Comparison of Madison and Minnelusa water chemistry.

Treatment and Storage Ponds for Deep Well Injectate

Radium is the only radioactive waste expected to occur in the ISR waste fluids.

The Class V permit requires removal of radium to below radioactive waste standards.



Importance of the Public Comment Period & Public Hearings

- The public comment period an important part of the EPA permitting process.
- The reason draft permits are issued is to initiate a public review process to get public input, which may affect the EPA's final decision on these permits.
- EPA regs require a 30 day comment period and a public hearing IF the public requests a hearing.
- This public comment period: March 6 - May 19
- The EPA has schedule five days of public hearings.